Overview of Stated Preference Methods

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Outline

- Introduction to stated preference (SP) methods – what and why
- Common elements of SP surveys and data collection considerations
- Contingent valuation
- Choice experiments and contingent ranking
- Contingent behavior
- SP criticisms
- Advances in SP
- Challenges/obstacles and getting around them

Stated Preference Methods

- Methods that involve asking individuals questions that can be used to infer economic values either using direct or indirect expressions of economic value
  - Constructed market transactions
  - Measure willingness to pay (WTP) or willingness to accept compensation (WTA), depending upon property rights
- Capable of measuring the total economic value (TEV) of a non-market good (TEV = use value + nonuse value)
- In recreation demand, often used when important variables (e.g., environmental quality, regulations) do not vary, are absent, or of poor quality in behavioral data or there is no behavioral trace
- Useful for ex ante analysis

SP Survey Common Elements

- Description of the good to be valued
- Method of provision
- Payment vehicle
- Decision rule
- Value elicitation question
- Follow-up questions (e.g., to identify protest respondents)
- Auxiliary questions (e.g., demographics, behavioral questions)

SP Survey Considerations

- What is the appropriate population from which to sample? Is there a sampling frame available to fully access the population? Will my data be representative of the population(s) of interest? Is sample stratification necessary?
- What survey mode will yield the best response rates and highest quality data (telephone, mail, internet, in-person, or mixed mode)?
- How can non-response behavior (item and unit) be minimized?
- What sample size(s) is needed for sufficient precision in the estimates?

Types of SP Methods

- Methods covered
  - Contingent valuation (CV)
  - Choice experiments (CE)
  - Contingent ranking (CR) - briefly
  - Contingent behavior (CB) - briefly

- Methods not covered
  - Contingent rating
  - Paired comparisons
  - Market stalls, citizen expert groups (Powe, 2007)

- Terminology is messy and sometimes overlapping
  - CE, CR, paired comparisons, and contingent rating are often lumped together as “conjoint analysis”
  - Carson and Louviere (2011, ERE) suggest new nomenclature for the various methods and getting rid of the term conjoint analysis altogether
  - Some CV methods are identical in form to CE

Contingent Valuation

- Term refers to any of several methods for collecting preference information from respondents using survey questions
- The idea for a "direct interview method" for collecting natural resource economic value information proposed by Ciriacy-Wantrup (1947)
- First used by Davis (1963) to value big game hunting in Maine – "open-ended" CV question
- Since 1980s, CV has been used (and researched) extensively
  - *Ohio v. Dept of Interior* (1988) – can be used in damage assessments
  - NOAA blue ribbon panel (1993) – can be used to reliably estimate nonuse (passive use) values

Main Types of CV Methods

- Open-ended CV
- Referendum CV
  - aka dichotomous choice CV
- Payment card CV

Open-ended CV

- "How much are you willing to pay for Y?"
  - Direct measure of WTP

- Criticisms
  - Incentive compatibility (strategic bias)
  - Cognitively unfamiliar → lots of "protest zeros"

- Econometric modeling: regression analysis of WTP = $f(\mathbf{z}|\beta) + \varepsilon$, where β are parameters to estimate, ε is a disturbance term, and $\mathbf{z}$ is a vector of individual characteristics
  - "Excess zeros" problem: Tobit model can correct

Referendum CV

- "Would you be willing to pay $X for good Y?" (yes/no) – take it or leave it
  - Vary X over people (experimental design)
  - Can be incentive compatible (Carson and Groves, 2007)
  - Recommended CV question format by NOAA Panel

- Criticisms
  - Indirectly measures WTP and does not provide much information
  - Anchoring bias

- Econometric modeling
  - Analyze using random utility maximization (RUM) models (Hanemann, 1984)
    - Pr(yes) = Pr(U[yes] $\geq$ U[no]) and Pr(no) = 1-Pr(yes)
      where U = $\gamma \cdot (M-X) + \beta \cdot \mathbf{z} + \varepsilon$, M = income, $\mathbf{z}$ = individual characteristics, ε~TEV → logit, ε~normal → probit
  - Alternative: Analyze by modeling WTP directly (Cameron, 1988)
    - Pr(yes) = Pr(WTP $\geq$ X)
      where WTP = $f(\mathbf{z},M) + u$, u~ logistic → logit, u~normal → probit
    - Dual approach to the RUM model (McConnell, 1990)

- Common variants
  - Adding follow-up referendum questions
    - Double-bounded dichotomous choice or referendum with follow-up
    - Bidding game

Payment Card CV

- Respondents shown card/table with an array of payment values and asked to choose from them

- Criticisms
  - Range bias

What is the maximum amount you would pay?
Please circle the dollar amount from the list below.

$0	$1	$5	$10	$15
$20	$25	$35	$50	$100
More than $100				

- Econometric modeling
  - Can be analyzed using RUM models by modeling Pr(WTP is between $\$X_1$ and $\$X_2$)
  - Can assume $\$X_1$ = WTP and analyze as if it were an open-ended CV

CV and Recreational Fishing

- Lots of applications value a day of fishing or some quality aspect (e.g., change in harvest/catch rate)
  - Mostly freshwater studies
  - NMFS studies?

- Useful for valuing a specific good that is described
  - But ONLY good for valuing that specific good

- Generally not used when a functional relationship is desired
  - i.e., when a valuation function that depends upon one or more policy variables is desired

Notes on CV Data and Estimation

- How many questions to ask?
  - Multiple good valuation
  - Sequencing and nesting issues (Carson, Flores, and Meade, 2001)
  - Variations of same question but altering one or more characteristics → is an attributes-based SP method more appropriate?
  - Cognitive difficulty and fatigue considerations

- Many econometric fixes have been developed to deal with problems
  - Anchoring models
  - Sample selectivity
  - Protest respondents and excess zeros

- Most common estimation models for analyzing CV data are usually available in standard routines within commercially-available software packages (e.g., SAS and LIMDEP/Nlogit)

Choice Experiments

- Based on household production function concept that goods are valuable because their characteristics are valuable (hedonics)
- Popular in marketing and transportation literature
- Ask respondents to choose between two or more alternatives that differ in attributes and costs
- V_i = f(fishing location, #days, cost, and species-specific bag limit, catch/day, size), where i = A, B
- V_C = g(individual characteristics)

D6 **Consider the three choices in the table. Below the table, indicate which of these three choices you like best and which you like least.**

	Choice A	Choice B	Choice C
Fishing location	Southcentral	Southeast	Do something other than Alaska saltwater fishing
Number of fishing days	2	2	
Fish targeted	Halibut	Halibut	
Daily bag (take) limit *Number of fish you can keep each day*	1	3	
Catch per day *If your catch is more than the limit, some fish are released*	2	4	
Average size of fish caught	80 lbs.	40 lbs.	
Fish targeted	King salmon	Silver salmon	
Daily bag (take) limit *Number of fish you can keep each day*	3	6	
Catch per day *If your catch is more than the limit, some fish are released*	1	1	
Average size of fish caught	50 lbs.	12 lbs.	
Fishing trip cost per person **(ALASKA-ONLY COSTS)** *Can include transportation, food, lodging, and other fishing-related costs in Alaska*	$700	$1000	

	Choice A	Choice B	Choice C
Which do you like best? *Check one box ------>*	☐	☐	☐
Which do you like least? *Check one box ------>*	☐	☐	☐

Notes on CE Question Format

- Two alternative choice with a status quo or opt out choice is same as referendum CV
- Cognitive burden increases with choice alternatives (two or three choice alts common)
- What are respondents asked to identify?
  - Best choice
  - Worst choice
  - Best and worst choice
  - Full ranking (same as **contingent ranking**)
- "Brand" or choice alternative "labels" may induce undesirable effects (versus generic labels)
- Repeated questions – fatigue, response effects

Selecting Attributes in CE

- Key decision
  - Utility function allows one to estimate marginal value of a change in attributes
  - Attributes closely linked to policy variables (e.g., bag limits)
  - Focus groups and cognitive interviews useful for refining

- Cost/price is necessary if you want welfare estimates: e.g., for linear utility with no income effects, WTP = $(1/\gamma)\cdot(V^1-V^0)$, where γ = MU$

- Non-cost attributes
  - Attributes that do not vary in RP data sufficiently but with policy importance
  - Characteristics that capture the heterogeneity of the good

- Input from managers, policy analysts and target population useful in determining appropriate range of values attributes can take

CE Experimental Design

- Issue: How to select the set of attribute levels to show respondents in each question
  - Some CV methods require selecting price/cost vector (Kanninen, 1993)
  - Poor experimental designs → inability to identify some effects and diminishes efficiency of estimates

- Approaches
  - Full factorial design (usually not feasible)
  - Fractional factorial design
  - Randomized designs
  - Efficiency-based designs

Efficient Experimental Designs for CE

- Choosing the experimental design to maximize the efficiency of estimates based on the underlying assumed modeling (non-linear)
  - Bunch, Louviere, and Anderson (1996), Huber and Zwerina (1996, JMR), Sandor and Wedel (2001, JMR), Lusk and Norwood (2005, AJAE), Ferrini and Scarpa (2007, JEEM)

- Common practice in efficient design construction
  - Assume an underlying multinomial logit (MNL) model with linear utility
  - D-efficiency criterion used to select experimental design
  - Specific D-efficiency criteria: D_0-error and D_p-error
    - Both based on the determinant of the information matrix, $|\Omega|^{-1/K}$

- Software
  - Warren Kuhfeld's SAS macros
  - Johnson, Kanninen, Bingham, and Ozdemir (2006, book chapter) – appendix has GAUSS and SAS code

- Removing unrealistic choices reduces efficiency, but is necessary

Econometric Models for CE

- Discrete choice econometric models used to analyze data from CE and some types of CV data
  - Random utility maximization: (a) $U_i = V_i + e_i$ and (b) choose alt with largest U
  - Most common specification for the conditional indirect utility is linear-in-parameters and linear in cost (no income effects)

- Models based on extreme value errors
  - Conditional logit
  - Nested logit
  - Mixed, or random parameters, logit
  - Latent class logit
  - HEV

- Models based on normal errors
  - Multinomial probit

- Panel models are used with repeated choices

- Rank-ordered models are used when ranking data are available

CE and Recreational Fishing

- Several studies have been conducted using CE in recreational fishing context

- Common types of information SP models are capable of providing for recreational fishing management decisions
  - Value of fishing trips
  - Value of a fish
  - Value of other fishing-related factors
  - Relative value of fishing-related factors relative to each other (for trade-off analysis)
  - Probabilities of participation in fishing and how factors change that

- CE is more flexible in providing this information than CV
  - Ecosystem-based management

Contingent Behavior

- Questions that ask respondents what they would do in a hypothetical situation
- CB data is generally collected in the same form as the RP data (e.g., hypothetical site choice CB data to complement actual site choice RP data), though not always
- Most often combined with RP data in an RP-SP model
  - Analysis usually involves pooling the data and analyzing in the RP framework
  - Tests for pooling
  - Convergent validity concern

Criticisms of SP Methods

- Some general criticisms
  - Hypothetical bias (RP/SP comparisons, cheap talk, respondent certainty)
  - Existence of nonuse value (lack of corroboration)
  - Moral satisfaction or warm glow effects (Kahneman and Knetsch, 1992)
  - Constructed preferences (Schkade and Payne, 1994)
  - Scope sensitivity (Carson and Mitchell, 1993; Lew and Wallmo, 2010)
  - Mental accounting (Thaler, 1985)

- Experimental economics research has attempted to test many of these criticisms

Advances in SP

- What recent advances have been made in this area?
  - Computing power has improved
  - More advanced econometric models have been developed that improve model estimates (e.g., preference heterogeneity)
  - Understanding of cognitive processes

- How will these advances improve our ability to analyze management options?
  - Lead to better questions (description of good, question formats, etc.) → better data → better estimates
  - Lead to improved modeling → better estimates
  - More confidence in estimates

Challenges/Obstacles

- SP welfare and demand estimates are only as good as the data and the modeling that generate them
  - Survey limitations
    - Representativeness of data
    - Response rates and non-response behavior
  - Description of good, payment vehicle, and other features – credible and feasible?
    - Available science
    - Requires considerable testing and external review
    - Care in dealing with counterfactual info
    - Dealing with uncertainty and minimizing complexity
- Cross-sectional data – changing preferences?

Challenges/Obstacles (cont.)

- Aggregation – data are from surveys with less than 100% response rate
  - How do we treat unit non-respondents?
  - How do we interpret the mean value measures with respect to the population?
- Timeliness
  - Developing a SP survey, collecting the data, analyzing the data, and publishing the results in peer-reviewed outlets can take a long time
  - Policy needs are often more immediate
  - Regulatory landscape may change making the results not as useful
- Communication of results
  - Interpretation of results
  - Confidence bounds

Challenges/Obstacles (cont.)

- Funding and resources
  - Developing, testing, and implementing a good SP survey is costly
    - More qualitative pretesting is necessary relative to other surveys
    - External review may be required
- Workloads, personnel, expertise, and priorities
- Modeling
  - Models used to analyze SP data have become increasingly complex (MNL no longer sufficient)
    - Many require simulation-based estimation
    - Many require manually programming in a language like GAUSS, R, or Matlab
  - Many models require large datasets (e.g., mixed logit models)
- Critics of SP methods

Getting Around Short-term Obstacles

- Improve communication with Councils and Regional staff to keep abreast of issues
  - What issues are on the horizon?

- Build in flexibility
  - Use CE instead of CV when possible
  - Choose range of attributes and levels that are not currently on the table, but might be in the foreseeable future
  - Use CB when good RP data is available to supplement

- Adhere to best practices in developing, testing, implementing, and analyzing data from the SP survey

Getting Around Long-Term Obstacles

- Decrease administrative obstacles
  - Expedite OMB approval under the Paperwork Reduction Act
  - Blanket approvals for non-MRIP regions (e.g., Alaska and West Coast)
  - Barriers to publishing results (e.g., minimize internal review time)
- Regular and sufficient funding for data collection to ensure adequate testing can be done and collection of data with large enough sample for analyses
- FTEs with sufficient training and background in survey methods and econometrics to successfully design, test, and implement SP surveys and analyze and interpret the results in a timely fashion
- Ensure researchers have sufficient resources like statistical software and computing power
- Educating decision-makers on SP
- Collection of recreational fishing economic information as a priority? EBM?

Automation

- Feasibility of automating model estimation over multiple years/projects depends upon a number of factors
  - What we are trying to automate over (datasets from different regions/surveys, identical survey from different years, etc.)
  - Willingness to rely on "standard" models that may not address problems specific to the data
  - Whether data will be collected in identical fashion and form

- The technology is available to be able to automate the calculation of results for user-defined purposes
  - Example: The calculation of the change in trip value with a specific regulation not reported on in any report/paper, but within the feasible domain of the estimated model
  - Without proper interpretation of the results and documentation to support it, this is generally not a good idea